8.Outreach Activities

The Laboratory for Atmospheres actively participates in NASA's efforts to serve the scientific community and foster education at all levels. Our outreach activities include collaborative ventures and cooperative agreements with universities. We also conduct lectures and seminars, university courses, mentoring programs at Goddard and at universities, public information programs, and other educational activities. Our outreach activities are multicultural and target both the general public and the international scientific community.

Twenty Laboratory scientists have participated in educational projects in secondary schools, eight have mentored undergraduate students, six have mentored graduate students, one has advised a master's degree student, sixteen are advising doctoral students, seven have taught university courses over the past three years, nine are adjunct or visiting professors at universities, and thirty-one have active collaborations on joint research projects at universities.

Cooperative Agreement with Howard University and Other Historically Black Colleges and Universities

The Laboratory continues its research and educational activity with Howard University's Center for the Study of Terrestrial and Extraterrestrial Atmospheres (CSTEA) program. NASA funds this program. A Technical Review Committee site visit was held to evaluate the CSTEA program, make recommendations for the second year of their cooperative agreement with the Laboratory, help them with their strategic planning for future growth, and develop new funding sources for their atmospheres program. The Laboratory works with CSTEA to promote the Howard University Program in Atmospheric Sciences (HUPAS), the only Historically Black College and University (HBCU) program that offers the Masters and Ph.D. degrees in atmospheric science. Scientists from our Laboratory contribute to the HUPAS program as lecturers, advisors to graduate and undergraduate students, and adjunct professors teaching a number of their courses. A series of seminars has been given at Howard University as supplemental instruction in their Atmospheric Sciences Program.

We've also entered into a second cooperative agreement with Howard University, the CSTEA HBCU Academic and Research Consortium, or CHARC for short. CHARC is a partnership that includes the Howard University's CSTEA, five Historically Black Colleges and Universities (HBCUs), and GSFC. This consortium pays for students from the five HBCUs to earn a Masters degree from Howard University in the atmospheric sciences while participating in NASA research. Laboratory scientists served as mentors for some of the CHARC students during the summer. Collaborative experimental programs include aerosol satellite validation measurements using ground-based and airborne instruments, and Raman Lidar measurements of ozone using the Howard University Beltsville optical site.

Graduate Student Summer Program

The Laboratory for Atmospheres participates in a program administered by the Universities Space Research Association, in collaboration with the Goddard Space Flight Center's Earth Sciences Directorate. The program offers a limited number of graduate student research opportunities each Summer. The program is designed to stimulate interest in interdisciplinary Earth science studies by enabling selected students to pursue specially tailored research projects in conjuction with

Goddard scientific mentors. Please use the following link for further details.

http://phoenix.gvsp.usra.edu/gssp/

K-12 Education

Laboratory staff participates in K-12 education in a variety of ways. Laboratory scientists presented lectures and demonstrations to K-12 schools and youth groups to help develop an early interest in science. Laboratory scientists have also mentored students in grades K-12. Mentoring took place with students in the Eleanor Roosevelt High School Science and Technology Internship Program, where students performed research on Mesoscale Atmospheric Processes. Members of the Laboratory served as judges for local science fairs and made presentations at High School Career Days to foster interest in NASA research. One Laboratory scientist served on a panel for the local school district to decide on high school re-districting and new curriculum in the northeast Montgomery County Consortium. As a result, Earth Science has been included as part of an enhanced science program at Paint Branch High School in Burtonsville. Additionally, one laboratory scientist is currently serving as one of the Host Researchers for the JASON Foundation for Education's JASON X expedition to the rainforest. The JASON expedition reaches thousands of students and teachers around the world.

Monsoon 2 CD-ROM

The Monsoon is an interactive multimedia application on CD-ROM created to stimulate students and faculty in grades 9-12 to investigate and understand monsoon and data assimilation processes. The CD-ROM contains three primary elements: the Monsoon Presentation, the Data Visualizer, and the Teacher's Guide.

Laboratory scientists collaborated with a graphics designer/artist to develop the Monsoon Presentation, a multi-media introduction to the importance of the monsoon in Earth's climate system. This section illustrates what data assimilation is and how it is used to study the monsoon in Southeast Asia.

The Data Visualizer gives graphical answers to questions about temperature, precipitation, and wind for six cities over the period 1980 to 1995. There are 12,000 graphs embedded in the CD-ROM, which may be accessed by clicking on one interface screen. Teachers and students can do comparison studies using both assimilated and station data products. Examples for using the Visualizer in student research projects are included in the Teacher's Guide.

The newly written Teacher's Guide and Student Activity book will be available on the CD-ROM and in print. They include curriculum materials that focus on climate variation and development of data analysis skills. The books provide a performance-based format that aligns with new education standards. In addition to the monsoon resources already on the CD-ROM, this guide includes temperature data captured every 5-10 minutes for a few weeks of the winter of 1998-1999. The guide also includes global data extracted from the Interdisciplinary Data collection at the Goddard Space Flight Center. Teachers and students can also select from a variety of hands-on activities, classroom demonstrations, three short-term research exercises, and six long-term investigation projects. A variety of resources are offered, including connections to Global Learning and Observations to Benefit the Environment (GLOBE) program activities, and guidance on writing lab reports and grading student research. Selections from the National Research Council's National Science Education Standards (NSES) have been included to assist teachers in adopting the inquiry-driven learning methodology and style that is supported by the Monsoon CD-ROM Teacher's Guide and Data Visualizer.

An additional file contains long-term, monthly, temperature and precipitation data that encourage the user to explore further. Included are data sets for Bombay, Calcutta, London, Los Angeles, Seoul, and Washington, D.C. Further information on the CD-ROM may be obtained from http://dao.gsfc.nasa.gov/monsoon_cd/

University Education

Laboratory scientists have taught undergraduate and graduate courses at universities and have participated in mentorships for teachers and students under a variety of GSFC programs.

Our scientists are involved as teachers in a variety of settings. In June, Laboratory scientists presented a graduate series of lectures on Global Environmental Issues, in conjunction with scientists from other institutions. In a venture with other Goddard Laboratories, our scientists participated in delivering an MIT course for credit on the subject of Techniques in Remote Sensing. This course for MIT students took place during the semester break of January 1998. The course was an Independent Activity Period course (IAP) during which twelve students spent a week at Goddard and a week at MIT. The Laboratory presented lectures for 1 1/2 days during this seminar series. In addition, Laboratory staff have supervised independent study courses at Mt. Holyoke College, MA.

Laboratory scientists mentored nine undergraduate students and three graduate students during the summer of 1998. The Code 910/970 Summer Institute on Atmospheric and Hydrospheric Science brings about fifteen undergraduate students to Goddard for two months of intensive research. Some of the students return to the Laboratory to work on other programs, and some have been mentored by Laboratory scientists for their thesis work at their home institutions.

Public Information and Education

Laboratory scientists working with other laboratories at Goddard and outside institutions have passed their knowledge and interest in Earth and space science to the general public via public information and education programs. Laboratory staff created a permanent display on the three-dimensional temperature structure of the Earth for the GSFC Visitor Center. Laboratory scientists have given newspaper and radio interviews. The TRMM Office provided a booth for visiting teachers. The TRMM project also established a comprehensive Education/Outreach program in which Laboratory personnel were funded by DDF resources to promote TRMM science to the education community and the public. TRMM scientists in the Laboratory regularly appeared on major media outlets (Earth and Sky Radio, CBS, NBC, ABC,and CNN) this year in support of the mission. In addition, Directorate personnel have spoken at and conducted several educator workshops in support of TRMM. We forwarded answers to science and engineering questions to The Mad Scientist Network, a group based at Washington University in St. Louis, that answers questions submitted to them by students all over the world. Laboratory scientists contributed to Goddard Scientific Visualization Studio efforts to collaborate with the Smithsonian Institution, the American Museum of Natural History (NYC), Disney World, EPCOT, and the White House in communicating scientific discoveries to the public. The Laboratory's images and animations have appeared in the media, including recent TV segments with ABC's Peter Jennings and NBC's Tom Brokaw, and top billing of Goddard and NOAA images of hurricanes in *Time*, *Life*, and the covers of *Popular Science*, *Newsweek*, *Der Spiegel*, and *The Weekly Reader* .

GOES Server

A Web server has been provided that keeps about 50,000 recent GOES images on-line, including full-resolution sectors for all of the United States for the last two days. In addition, there are extensive scrapbooks of digital movies and pictures of important weather events observed by the GOES-8 and GOES-9 satellites since they were launched in 1994 and 1995, respectively.

Terra Outreach Synopsis

Under the direction of Yoram Kaufman (Code 913) and Claire Parkinson (Code 971), Terra and EOS PM-1 Project Scientists, respectively, a coordinated effort is underway to foster greater cooperation and synergy among various outreach groups within the EOS community. As such, each of the activities described below receives contributions from various persons strategically located in different organizations and/or codes within the community.

The Terra Project Science Office has written and printed 13,000 copies of a Terra mission overview brochure (hardcopies available from Charlotte Griner). The layout and design of the brochure, as well as funding for its printing, came from Code 900. Additionally, this brochure, as well as many more images, animations, and information, is available on the new Terra Web site http://terra.nasa.gov/ which is also maintained by the Terra Project. An EOS PM-1 Overview Brochure is currently being planned by the PM-1 Project Scientist.

The Terra & PM-1 Projects are spear heading creation of the Earth Observatory (EOb). (The prototype URL is http://

modarch.gsfc.nasa.gov/EO/eo_home.html/; login and password are both "eob".) This Web environment will become the NASA Web portal where the general public goes to learn about the Earth. As such, it will showcase new images and science results from EOS missions. The focus in its first year of operation will be on SeaWiFS,TRMM, Landsat-7, SeaWinds, and Terra. All resources produced for the EOb will be freely available for use by the EOS community, museums, educators, public media, regional "stakeholders," environmental awareness groups, and interested members of the general public. (While leadership for this site resides in Code 913, significant contributions to its development are coming from Codes 900, 902, 912, 921, 922, 923, 935, 971, and 3200 at JPL; as well as the American Museum of Natural History and East Carolina University.)

As a pathfinder for the EOb, the Terra Outreach Team constructed the Global Fire Monitoring Web site, under the direction of Drs. Chris Justice (U. of Virginia) and Yoram Kaufman. The URL is http://modarch.gsfc.nasa.gov/fire_atlas/. (Significant contributions toward construction of this site came from Dr. Justice 's team at UVa, as well as Codes 902, 912, 913, and 922.)

To provide overarching guidance and review for the Terra outreach activities, as well as to flagmature new science results ready for public release, an Executive Committee for Science Outreach (ECSO) was formed. This committee is chaired by Dr. V. Ramanathan, of the Scripps Institute 's Center for Clouds, Chemistry, and Climatology. The purpose of this committee is to "harvest" new Terra science results that are ready for public release, as well as to help temper the presentation of new results with respect to socio-political implications they may have.

Finally, to meet the public media's (primarily TV, newspapers, and our EOb Web site) requirements for quick access to satellite imagery relevant to significant, news worthy Earth events (e.g., severe storms, floods, El Niño, volcanic eruptions, wildfires), the Terra Project is forming a Rapid Response Network, to be headed by Jim Collatz (Code 923), Assistant Terra Project Scientist. After launch, this network will enable us to access and produce remote sensing imagery over targets of interest within a matter of hours to days after acquisition.

Global Learning and Observations to Benefit the Environment (GLOBE)

The Laboratory has contributed to the Goddard Scientific Visualization Studio effort in support of the GLOBE Project, jointly with the Goddard Scientific Applications and Visualization Branch. GLOBE is a White House program led by Vice President Al Gore as a worldwide science and education program coordinating the work of students, teachers, and scientists to monitor the global environment.

International Public Information

The Laboratory has assisted the outreach specialist at the DAAC in organizing a U.S. poster for the UN convention on telecommunications in Geneva, Switzerland, dealing with the practical importance and significance of satellite data for weather prediction and outbreaks of infectious diseases. The Center Director recommended that this poster be displayed at the GSFC Visitor Center and at NASA Headquarters.

NASA/NBC-4 (WRC-TV) ESIP-3 Cooperative Agreement

Laboratory scientists are participating in a Cooperative Agreement Notice (CAN) Earth Science Information Partners (ESIP-3) Project with NBC-4. The NASA/NBC-4 Meteorological/Scientific Visualization for Broadcast Television News project is intended to accomplish two goals. The first is to increase the exposure of Earth Science data to a much broader user community, the American people, by promoting such EOS missions as TRMM, Landsat 7 and Terra (AM-1) through innovative visualizations on WRC-TV and WeatherNet 4. The second is to optimize the previously developed tools for rapid display and value-added product creation of both ESE and commercial remote sensing data sources through valuable partnerships with public and corporate organizations. In addition, we will merge the power of GIS technology and visualization technology to provide easy-to-understand pictures in two and three dimensions for television news and weather broadcasts. These data sets would be integrated into television weather casts on WRC-TV in Washington, DC, and

offered to other NBC owned and operated facilities worldwide.

NASA/NOAA: Earth Science Electronic Theater '999

Visualizations produced by the NASA Goddard Visualization & Analysis Laboratory (VAL/912), as well as other Goddard and NASA groups using NASA, NOAA, ESA, and NASDA Earth science data sets have been shown around the world using new display technologies. The Electronic Theater has been presented at universities, high schools, museums,and Government laboratories to scientists and the general public.

New methods have been demonstrated for visualizing, interpreting, comparing, organizing, and analyzing immense HyperImage remote sensing data sets and three dimensional numerical model results. We call the data from many new Earth sensing satellites HyperImage data sets, because they have such high resolution in the spectral, temporal, spatial, and dynamic range domains. The traditional numerical spreadsheet paradigm has been extended to develop a scientific visualization approach for processing HyperImage data sets and 3D model results interactively. The advantages of extending the powerful spreadsheet style of computation to multiple sets of images and organizing image processing were demonstrated using the Distributed Image SpreadSheet (DISS). The DISS is being used as a high performance test bed Next Generation Internet (NGI).

Responsible NASA official: Bob Theis